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Mothers' Preventive Health Care Practices and Children's Survival in Burkina Faso: Findings from Repeated Cross-sectional Household Surveys

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Abstract: The significant reduction in the level of child mortality in both developed and developing countries over recent decades has led to an improvement in children's health. The implementation, monitoring, and evaluation of the health programs needed to reduce child mortality require determination and an understanding of the factors responsible for this reduction. This study investigated factors that have contributed to the recent improvement in the survival of children under five, focusing on the contribution of preventive health care in improving children's survival rates in Burkina Faso.

The data used come from baseline and end-line surveys designed to evaluate the impact of performance-based financing (PBF) on health programs in Burkina Faso. Using time-series for health districts and child-level logistic regression models, we estimated the effect of preventive health care, as summarized by the changes in the composite coverage index (CCI), on under-five child survival of temporal trends and covariates at the household, maternal, and child levels.

At the health district level, a unit increase in standardized CCI was associated with an improvement in under-five child survival after adjustment for survey period effects. The linear regression analysis showed that a standardized unit increase in CCI was associated with an increase in the percentage of children under five who survive. At the child level, the logistic regression showed that a skilled attendant at birth (SBA), wealth index, and mother's parity were associated with under-five children's survival, after adjustment for the survey period effects and a set of household, maternal, and child-level covariates.

Preventive health care is important in improving under-five children's survival, whereas the effects of economic growth in Burkina Faso remain weak and inconsistent. Improved coverage of preventive health care interventions are likely to contribute to further reductions in under-five mortality in Burkina Faso.

Keywords: Child mortality · Preventive health care · Maternal and child health interventions · Burkina Faso

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1 Introduction and literature review

The health of children under the age of five is a major priority for developing countries (*Rockli et al.* 2018). According to recent studies, a significant reduction in the levels of child mortality over the last decades in both developed and developing countries has led to an improvement in children's health (*Houweling et al.* 2006; *Houweling/Kunst* 2009; *McKinnon et al.* 2014; *United Nations* 2013; *You et al.* 2015). Despite the overall decline in child mortality in developing countries, there are still unacceptably high levels in sub-Saharan African countries (*Adedini* 2013; *Harttgen/Misselhorn* 2006; *Rajaratnam et al.* 2010).

Like other African countries, Burkina Faso has a high level of under-five mortality (*Liu et al.* 2015; *Munos et al.* 2016). According to the results of the demographic module of the continuous multi-sector survey conducted in 2015, for every 1,000 live births 82 children die before their fifth birthday, and 43 do not reach their first birthday (*INSD* 2015). The results of this survey show that the mortality level of children under 5 declined between 1998 and 2014: from 177 to 82 deaths per 1000 births, respectively. The 2018 United Nations Development Program (UNDP) Human Development Index ranks it 182nd of 189 countries and territories with comparable data. The vast majority of the population (77 percent) lives in rural areas and is afflicted by a high illiteracy level (65.5 percent in 2014). In 2014, the poverty headcount ratio at the national poverty line was estimated at 40.10 percent of the total population (*INSD* 2015).

Previous studies have revealed considerable disparities in Burkina Faso in terms of health service delivery, quality of care and use of obstetric and neonatal care (*Amnesty International* 2009; *De Allegri et al.* 2011; *Dong et al.* 2008; *Gnawali et al.* 2009). Differences were thus observed between various socioeconomic groups in terms of health coverage and results, the differences being particularly marked among indicators relating to maternal and child health at the national level. Progress has been made in recent years to improve these indicators. Apart from inequalities in the risk of death, children are also exposed to inequalities in health care access (*Say/Raine* 2007; *Vilms et al.* 2017). These inequalities result from various institutional, economic, cultural, and individual factors (*Adedini et al*. 2014; *Adedini* 2013; *Boco* 2011; *Braveman et al.* 2004; *Corsi/Subramanian* 2014; *Liwin/Houle* 2019; *Pedersen* 2015; *Susuman* 2015; *Tsawe/Susuman* 2014). One of the direct determinants is the set of mothers' preventive health care practices (*Garenne/Vimard* 1984; *Ghimire et al.* 2019; *Houweling/Kunst* 2009; *Masuy-Stroobant* 2002a/b; *Mosley/Chen* 1984).

First, mothers are the primary caregivers for children. They are responsible for maintaining children's health by providing them with adequate food and training in personal hygiene, both of which are preconditions for preventing illness. They may also be responsible for taking the children to health-care centers when they are ill (*Masuy-Stroobant* 2002a; *Mishra et al.* 2019; *Ouedraogo* 1994).

Second, within explanatory frameworks for child mortality, maternal health-care behaviors represent intermediate variables through which socioeconomic and cultural factors can influence child survival (*Garenne/Vimard* 1984; *Houweling/Kunst* 2009; *Masuy-Stroobant* 2002a/b; *Mosley/Chen* 1984).

In the context of institutional change and the fight against poverty including improvement of the health system, mothers' behaviors have a major impact on their children's survival (*Garenne/Vimard* 1984; *Houweling/Kunst* 2009; *Masuy-Stroobant* 2002a,/b; *Mosley/Chen* 1984). The best strategies for improving child survival occur at the individual level (*Corsi/Subramanian* 2014; *Owais et al.* 2011; *Oyefara* 2014; *Pedersen* 2015; *Tsawe/Susuman* 2014). They involve mobilizing women to adopt behaviors conducive to child survival. Their ability to make better use of the health services available to them and to take responsibility for managing health problems is important for improving children's survival (*Susuman* 2015; *Tsawe/Susuman* 2014; *World Health Organization* 2011).

The implementation, monitoring, and evaluation of the health programs needed to reduce children's mortality require determination and a clear understanding of the factors responsible for making this phenomenon so prevalent (*Barbieri* 1991). Awareness of the contributory factors to this phenomenon is therefore crucial in order to identify or inform the existing health actions, with the aim of further improving the situation and reducing the persistent health inequalities among children from different social strata.

Analyzing the factors associated with child mortality is a particularly complex undertaking. This complexity results from the large number of factors likely to impact on child mortality: demographic, epidemiological, medical, sociological, environmental and genetic. In practice, not all of these data are always available for analysis in a single piece of research, which limited the scope of the previous studies.

The analytical framework adopted for this study is based on that established by *Garenne* and *Vimard* (1984). It distinguishes five levels of variables specific to the analysis: discriminating, independent, intermediate, determining and dependent variables. These correspond to the different levels of analysis and thus to the different levels of explanation. This analytical framework has been adapted in this study to take into account independent (place of residence, household income, mother's education, mother's work) and intermediate (situation of birth, behavior in matters of health, immunity) variables.

In this paper we therefore investigated factors that have contributed to the recent improvement in under-five children's survival in Burkina Faso using data from the baseline (2013) and end-line (2017) surveys for the impact evaluation of performance-based financing (PBF)[1] in Burkina Faso. Specifically, we focus on the contributions of the main preventive factors associated with under-five children's survival in Burkina Faso. In other words, we seek to determine whether antenatal care visits, family planning needs satisfied (FPS), skilled birth attendants at delivery (SBA), and vaccination best practices have contributed to improving the under-five children's survival rate in Burkina Faso.

[1] Performance-based financing (PBF) or pay-for-performance (P4P) is a form of incentive where health providers are, at least partially, funded on the basis of their performance to meet targets or undertake specific actions. It is defined as fee-for-service-conditional-on-quality (WHO).

2 Materials and Methods

2.1 Data source

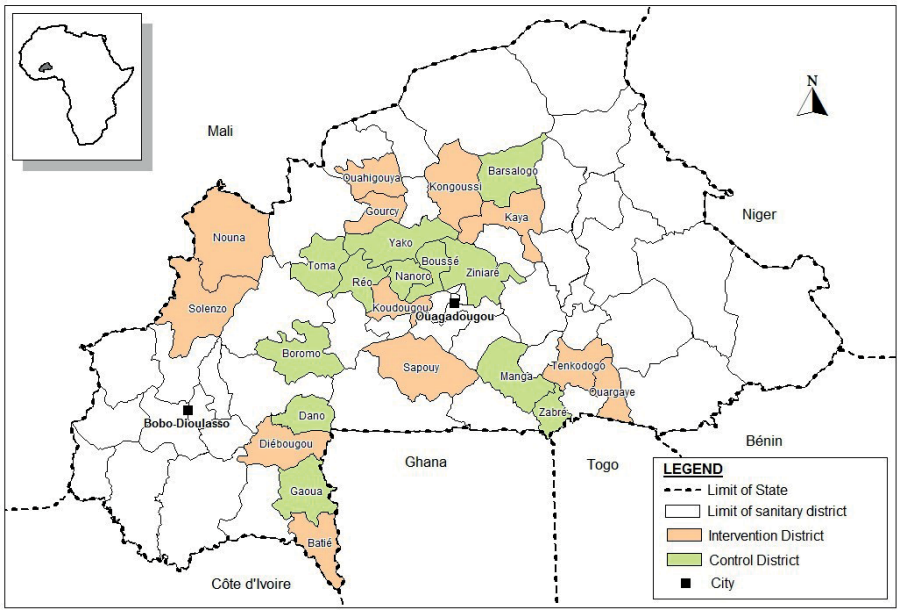
To achieve the objectives of this study, two quantitative data sources were used: baseline survey data (2013) and end-line survey data (2017) for the impact evaluation of Performance-Based Financing (PBF) in Burkina Faso. The PBF impact assessment was a blocked-by-region cluster random trial based on a pre-post comparison design. This process of random allocation seeks to ensure that the different study groups are comparable in terms of observed and unobserved characteristics that could affect treatment outcomes, thereby allowing average differences in outcomes to be causally attributed. The aim was to compare the indicators between intervention and control areas over a period before and after the intervention. In the protocol, it was planned to trace households and health facilities from the baseline survey to the final survey.

The choice of health regions was guided by the low level of maternal and child health indicators there. In each region (Center North, Center West, North, South West, Boucle du Mouhoun and Center Est), two health districts (HD) of intervention were selected by the Ministry of Health and two control districts in the same or in a neighboring region based on their relative proximity and similarity to the intervention districts in the targeted regions (Fig. 1). Within each HD of intervention, all the health facilities (HFs) – Centre de santé et de promotion sociale (CSPS), or Centers for Health and Social Promotion, and Centre médical avec antenne chirurgicale (CMA), a medical center with surgical satellite services, and a district hospital – were included. In each HD control, the number of selected HFs was proportional to the size of the health district.

A simple random draw of the number of HFs was performed in each health district based on one HF control for four HFs of intervention. A total of 529 HFs were investigated, including 428 rural CSPS. To be exact, 413 were visited in the intervention zones, and 116 in the control zones.

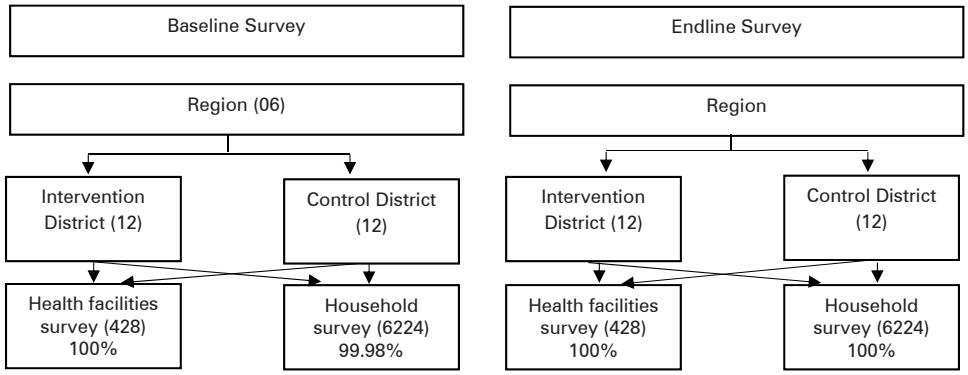
Each rural CSPS was associated with a village in its health area in which 15 households were selected for the survey. Fifteen households were randomly drawn from each village. Data collection for the baseline and end-line survey included a household and a facility-based survey. The household survey applied a two-stage sampling procedure (15 households per selected village). The questionnaire was administered to the head of household and women aged 15-49 years. The facility-based survey comprised different tools for data collection with different data sources and respondents: health facility records, providers' questionnaire, direct observations (curative consultations of under-5 and antenatal consultations), exit interviews (curative and antenatal consultations), Community Health Workers (CHW) (questionnaire). All health facilities and all households included in this study responded to the questionnaires. This paper is based on the household survey.

Fig. 1: Study area – Control and intervention health districts for baseline and endline survey, Burkina Faso



Source: Author's own production from base maps of the Geographic Institute of Burkina Faso

Fig. 2: Survey design diagram



Source: Authors' own calculations from baseline (2013) and end line (2017) survey data for the impact evaluation of Performance-Based Financing (PBF) in Burkina Faso

2.2 Study population and sample sizes

Two study populations were used in this study. First, we examined the study population based on an ecological time-series design, with health districts repeatedly observed over time. In this design, the lowest level of analysis was the health district, and 48 survey-period observations were available for analysis, covering 24 health districts observed in two periods (2013 and 2017).

Second, we used a repeated cross-sectional design, with children under five at the lowest unit of analysis. One of the main advantages of this second approach is its ability to take into account the factors that can influence both child mortality and economic development indicators. In this second level of analysis, children from both surveys were grouped together, and the child's likelihood of death was examined in the five years immediately preceding the survey. In total, 37,244 children were involved in this analysis, after exclusion of missing covariate data.

2.3 Selected Variables

Dependent variables

This study used two dependent variables, corresponding to the two study populations. In the ecological time-series design, the dependent variable is the proportion of under-five surviving children for the five-year reference period in each survey. In the child-level design, the dependent is the probability of child death occurring within five years prior to the survey. These are children born during the five years preceding the date of each survey used in this study. The question of the survival status of each live-born child made it possible to distinguish between surviving and deceased children. The age at death was recorded for each child who died.

Intermediate variables

The independent variables are those that report on mothers' practices in preventive health care. Based on prior literature and the database used in this study, we selected six preventive health care measures that have been shown to reduce child mortality from the major causes of under-five deaths, and that can be summarized as a composite index for comparability (CCI) between HDs and within HDs over time (*Aaby et al.* 1996; *Barros/Victora* 2013; *Victora et al.* 2005, 1997). The preventive health care measures included were family planning needs satisfied (FPS), skilled birth attendants at delivery (SBA), at least one antenatal care visit with a skilled provider (ANCS), and vaccination for children against diphtheria-pertussis-tetanus (DPT3, three doses), measles (MSL), and tuberculosis (BCG) vaccination. The coverage of these preventive health care measures at health district (HD) level was summarized using the CCI, which is based on the following weighted average of the six preventive health care measures:

$$\mathrm{CCI} = \frac{1}{3}(\mathrm{FPS} + \frac{\mathrm{SBA} + \mathrm{ANCS}}{2} + \frac{2\mathrm{DPT3} + \mathrm{MSL} + \mathrm{BCG}}{4}) \quad (1)$$

The CCI is a composite measure. The CCI gives equal weight to family planning and maternal and newborn care and immunization and has been proposed as an effective way to summarize and compare coverage of preventive health care across HDs and over time (*Barros/Victora* 2013; *Corsi/Subramanian* 2014).

Independent variables

At the child level, we used a variety of theoretically important household, maternal and child characteristics as covariates (*Victora et al.* 1997). With regard to the individual characteristics of the mother's social identification, this study retained maternal age at childbirth, parity, educational level, and occupation. Regarding children's characteristics, we used sex of the child, childbirth order, and child preceding birth intervals (*Corsi/Subramanian* 2014; *Vilms et al.* 2017). To better determine the impact of the social and household environment, we used the household wealth index and place of residence.

Statistical analysis

Most of the information collected on child survival focused on events that occurred in the five years prior to the date of each survey. Variables that operationalize mothers' preventive health-care practices (contraceptive methods used, vaccination, antenatal care, place of delivery and an attendance at delivery) were captured only for women who had had a live birth in the five years preceding both surveys.

Due to the nature of the data (collected from the retrospective surveys) and the objectives of our study, we adopted a longitudinal analysis approach. Longitudinal analysis reports on the evolution of the risk of death of a generation or a group of generations. The basic assumption is that children born in the same period are deemed to experience the same conditions that expose them to the risk of an indiscriminate death.

For this study we conducted two separate sets of analyses based on the two study populations described above. For the ecological time-series analysis, we apply linear regression models of form (*Corsi/Subramanian* 2014):

$$y_{ij} = \beta_0 + \mathrm{BC_j} + \mathrm{BS_{ij}} + \beta_1 \mathrm{CCI_{ij}} + e_{0ij} \quad (2)$$

where y_{ij} represents the percentage of surviving children for survey time i in HD j; β_0 represents the constant or the average percentage of surviving children holding CCI constant, and after accounting for HD differences ($\mathrm{BC_j}$); $\mathrm{BC_j}$ represents the HD specific dummy variables estimating percentage differences of surviving children between HD; $\mathrm{BS_{ij}}$ represents the effects associated with dummies for survey years;

$\beta_1 CCI_{ij}$ represents the percentage change of surviving children for a unit change in CCI; and e_{0ij} represents the residuals at the survey-year level i in HD j.

A second set of analyses was implemented using the child-level dataset. In these analyses, the basic model is a logistic regression model with a binary response (y=1 for child is alive during the reference period, y=0 for child death). The outcome of child survival, $Pr(y_{ij}=1)$, is assumed to be binomially distributed $y_{ij} \sim$ Binomial $(1, \pi_{ij})$ with probability π_{ij} related to the set of independent variables X and a random effect for each level by a logit link function:

$$\text{Logit}(\pi_{ij} = \beta_0 + BC_j + BS_{ij} + \beta_1 CCI_{ij} + BX_{ij}) \quad (3)$$

The intercept, β0, represents the log odds of child survival for the reference group, BS_{ij} is a vector of coefficients for dummy variables for survey years, $\beta 1 CCI_{ij}$ represents the log odds of child survival for a one-unit increase in CCI, and the BX represents a vector of coefficients for the log odds of child survival for a one-unit increase for each independent variable. Coefficients were estimated and presented as odds ratios with 95 percent confidence intervals. Odds ratios (ORs), adjusted odds ratios (aORs) and p-value were estimated to capture the association between each independent and covariate variable and child survival (*Harrell Jr.* 2015). The data analysis was performed primarily using version 13 of the Stata software.

3 Results

A total of 20,483 (55.0 percent) and 16,757 (45.0 percent) under-five children from the 2013 baseline and 2017 end-line survey, respectively, were included in the analyses for the impact evaluation of PBF in Burkina Faso. Between 2013 and 2017, the percentage of under-five surviving children increased in a majority (17 of 24) of HDs included in this study, although the rate of change varied across the HDs (Table 1). During this period, the CCI increased in all HDs from an average of 62.7 percent among all health districts in the baseline survey to 69.2 percent in the end-line survey (Table 1). During the period, the CCI increased in all HDs, but the percentage of under-five surviving children fell. Indeed, the percentage of under-five surviving children decreased in 7 of 24 HDs (Manga, Boussé, Yako, Réo, Gaoua, Batié, Boromo), while the CCI increased in these same HDs during the same period.

In both the baseline and end-line surveys, a positive association was seen between HD levels of under-five surviving children and CCI coverage, indicating higher rates of under-five surviving children in HDs with greater preventive health care coverage (Pearson correlation +0.30 [baseline] and +0.74 [end line], $p<0.001$, Fig. 3.1 and 3.2). This association held when the average changes in the percentage of under-five surviving children and CCI over time were examined (Pearson correlation 0.36, $p<0.001$, Fig. 3.3).

At an ecological level (model 1), the linear regression analysis showed that a standardized unit increase in CCI was associated with an increase of 10.0 percent in under-five surviving children after accounting for secular increases in the per-

Tab. 1: Sample size, percentage of under-5 children surviving and CCI for baseline and endline survey in 24 health districts, Burkina Faso

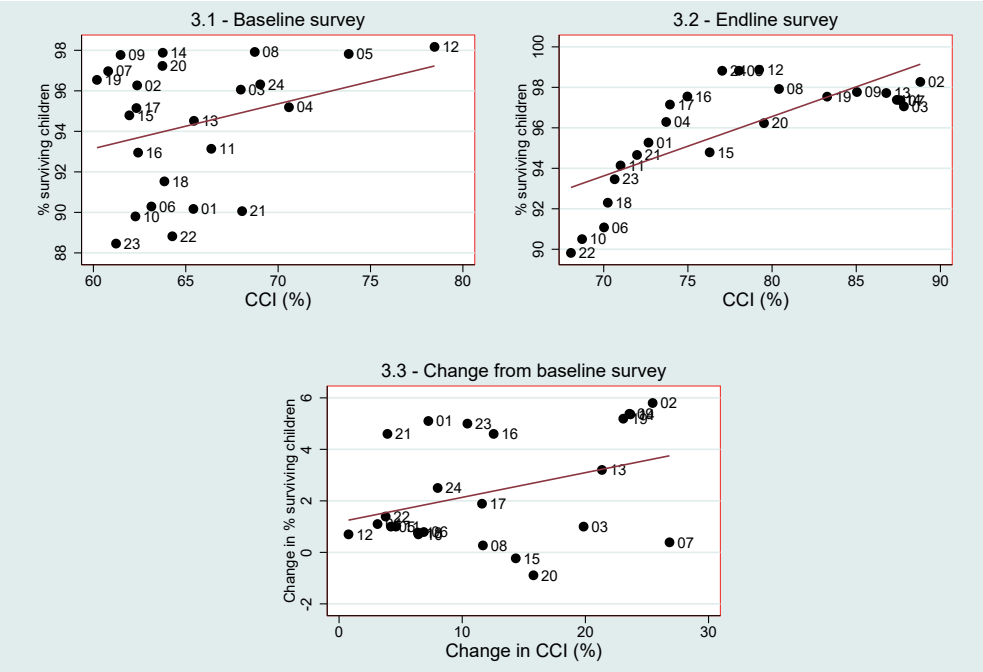
N°	Health District	Baseline survey (2013)			End line survey (2017)		
		N	% Surviving children	CCI	N	% Surviving children	CCI
03	Solenzo	1,166	93.1	62.0	1,080	99.1	70.8
09	Barsalgho	163	98.3	62.7	118	98.8	62.7
14	Nanoro	185	98.3	60.8	175	98.4	66.4
18	Gourcy	1,232	96.3	64.2	1,081	98.3	69.8
02	Nouna	1,678	87.1	62.2	1,484	98.3	69.7
04	Toma	410	94.8	63.6	326	98.3	72.6
08	Zabré	144	97.7	69.3	128	97.9	75.0
05	Manga	367	98.9	64.5	370	97.8	69.0
16	Sapouy	736	96.9	62.6	544	97.6	64.7
10	Kaya	2,001	96.0	63.1	1,680	97.5	68.6
19	Ouahigouya	2,361	96.8	60.5	1,952	97.5	72.5
17	Boussé	562	98.7	60.1	371	97.2	72.5
11	Kongoussi	1,225	91.4	66.9	1,219	97.1	71.9
07	Ouargaye	1,061	97.4	63.4	921	97.1	68.6
12	Ziniaré	707	94.8	62.7	492	97.0	69.2
13	Koudougou	2,289	95.0	62.4	1,601	96.7	65.9
06	Tenkodogo	961	94.9	60.9	732	96.4	67.5
20	Yako	690	97.0	61.1	503	96.2	69.8
15	Réo	691	98.2	62.0	508	94.8	66.0
24	Gaoua	181	94.1	57.5	152	92.8	65.5
21	Batié	354	98.1	58.6	324	92.7	66.9
01	Boromo	427	94.0	65.5	318	92.3	73.8
23	Diébougou	726	88.7	61.3	552	91.5	66.0
22	Dano	167	89.3	64.3	121	89.8	67.4
	Total	20,483	94.8	62.7	16,757	97.0	69.2

Source: Authors' own calculations from baseline (2013) and end line (2017) survey data for the impact evaluation of Performance-Based Financing (PBF) in Burkina Faso

centage of under-five surviving children as captured by the survey period's fixed effects (Table 2). In these analyses, CCI was associated with an increase in under-five surviving children, indicating a multiplier effect of under-five surviving children independent of survey period effects.

In a second model (model 2), a child-level analysis was conducted that included all preventive health care associated with under-five children's survival. Table 3 shows the sample sizes and unadjusted (OR) and adjusted (aOR) odds ratio by preventive health care variable: ANCS ($p<0.05$), SBA ($p<0.001$), and full immunization ($p<0.05$) were associated with under-five children's survival. Indeed, children

Fig. 3: Correlation between under-five children surviving and CCI at baseline (panel 3.1, n=24 surveys) and end-line (panel 3.2, n=24 surveys) surveys and correlation between the change in under-five children surviving and change in CCI from baseline (panel 3.3, n=24 surveys)



Source: Authors' own calculations from baseline (2013) and end line (2017) survey data for the impact evaluation of Performance-Based Financing (PBF) in Burkina Faso

whose mothers had no access to skilled antenatal care or a skilled attendant at birth are less likely to survive. The children under five who did not receive full immunization are less likely to survive.

Model 3 includes, in addition to the variables of preventive health care, covariates related to the household, the mother, and the child in the child-level analysis.

Table 4 presents the results of the bivariate analysis of child survival and the covariates related to the household, the mother, and the child. The wealth index, place of residence, mother's age at birth, maternal occupation, sex of the child, birth interval and birth order were significantly associated with the survival of the child. For multivariate analysis, the results of this model presented in Table 4 show that household wealth quintile (rich, richest) and received skilled attendant at birth (SBA) were associated with better under-five child survival. Indeed, it is noted that maternal age at childbirth (25–29 years, aOR=0.73) and high parity is associated with a low chance of under-five child survival (aOR=0.59 for 4-6 parity and aOR=0.42 for 7&+). Children from rich and richest households (aOR = 1.4 for richest, aOR=1.23 for rich, were less likely to die before their 5th birthday than those from the poorest households.

Tab. 2: Coefficients of the health district model (ecological model) predicting under-5 children surviving across 48 survey periods in 24 Health Districts, Burkina Faso (model 1)

Variables	Model 1	
	Beta	Standard Error (SE)
Survey period		
Baseline (reference)		
End line	0.33	1.26
Composite coverage index (per Standard deviation (SD) increase)	0.10	0.15
Constant	88.77	8.69

Source: Authors' own calculations from baseline (2013) and end line (2017) survey data for the impact evaluation of Performance-Based Financing (PBF) in Burkina Faso

Tab. 3: Bivariate odds ratios (OR), and multivariable adjusted odds ratios (aOR) of child survival according to preventive health care (Model 2)

Variables	Children, n	%	Odds Ratio	95% CI	P-value	Adjusted Odds Ratio	95% CI	P-value
Family planning needs satisfied (FPS)								
Yes	9,135	24.53	1.00			1.00		
No	28,112	75.47	1.05	(0.91 - 1.21)		0.94	(0.71 - 1.26)	
Received skilled antenatal care (ANCs)								
Yes	30,238	81.19	1.00			1.00		
No	7,006	18.81	0.93	(0.81 - 1.06)	*	0.46	(0.23 - 0.95)	*
Skilled attendant at birth (SBA)								
Yes	27,403	73.58	1.00			1.00		
No	9,841	26.42	0.74	(0.63 - 0.87)	***	0.69	(0.51 - 0.93)	*
Full immunization								
Yes	22,175	59.54	1.00			1.00		
No	15,069	40.46	0.83	(0.68 - 1.00)	*	0.80	(0.65 - 0.98)	*

*** p<0.001, ** p<0.01, * p<0.05, OR: Odds Ratios, CI: confidence interval, n = number of observations

Source: Authors' own calculations from baseline (2013) and end line (2017) survey data for the impact evaluation of Performance-Based Financing (PBF) in Burkina Faso

Tab. 4: Bivariate odds ratios (OR), and multivariable adjusted odds ratios (aOR) of child survival according to preventive health care, child, maternal and household-level covariates (Model 3)

Variables	Children, n	%	Odds Ratio	95% CI	P-value	Adjusted Odds Ratio	95% CI	P-value
Survey period								
Baseline	20,483	55.00	1.00			1.00		
Endline	16,757	45.00	1.57	(1.52 - 1.64)	***	1.47	(1.37 - 1.62)	***
Household wealth quintile								
Poorest	6,464	17.36	1.00			1.00		
Poorer	6,935	18.62	1.17	(0.99 - 1.39)	*	1.22	(1.00 - 1.50)	
Middle	7,36	19.77	1.13	(0.96 - 1.34)		1.21	(0.99 - 1.47)	
Rich	8,197	22.01	1.16	(0.99 - 1.36)		1.23	(1.01 - 1.49)	*
Richest	8,279	22.23	1.35	(1.14 - 1.59)	***	1.40	(1.14 - 1.72)	***
Area of residence								
Urban	16,958	45.54	1.00			1.00		
Rural	20,277	54.46	1.63	(1.47 - 1.81)	***	0.93		
Maternal age at child birth								
15-19	3,200	8.60	1.00			1.00		
20-24	8,328	22.37	1.12	(0.94 - 1.33)		0.79	(0.58 - 1.07)	
25-29	10,293	27.65	1.37	(1.13 - 1.67)	**	0.73	(0.54 - 0.99)	*
30-34	7,906	21.24	1.32	(1.05 - 1.65)	*	1.11	(0.80 - 1.53)	
35-39	4,855	13.04	1.35	(0.99 - 1.82)		1.29	(0.90 - 1.83)	
40-44	2,011	5.40	1.82	(1.02 -3.28)	*	1.25	(0.83 - 1.89)	
45-49	651	1.75	0.66	(0.24 - 1.83)		1.22	(0.70 - 2.11)	
Maternal education								
No education	35,041	94.08	1.00			1.00		
Primary &+	2,205	5.92	1.16	(0.92 - 1.47)		1.27	(0.92 - 1.75)	
Maternal occupation								
No working	17,592	47.23	1.00			1.00		
Working	11,887	31.92	0.87	(0.78 - 0.97)	**	0.92	(0.81 - 1.05)	
Parity								
1-3	17,443	46.83	1.00			1.00		
4-6	14,231	38.21	0.67	(0.60 - 0.76)	***	0.59	(0.50 - 0.70)	***
7 & +	5,570	14.96	0.57	(0.49 - 0.67)	***	0.42	(0.33 - 0.54)	***
Sex of child								
Male	18,935	50.84	1.00			1.00		
Female	18,309	49.16	1.14	(1.03 - 1.27)	*	1.13	(1.00 - 1.29)	
Birth order								
1st child	7,526	20.31	1.00			1.00		
2-3	8,938	24.12	1.46	(1.26 - 1.69)	***	1.23	(0.71 - 2.13)	
4-5	3,366	9.08	1.45	(1.18 - 1.78)	***	1.64	(0.91 - 2.92)	
>= 6	17,234	46.50	1.46	(1.28 - 1.66)	***	1.38	(0.79 - 2.42)	

Tab. 4: Continuation

Variables	Children, n	%	Odds Ratio	95% CI	P-value	Adjusted Odds Ratio	95% CI	P-value
Birth interval								
1st chid	7,915	21.25	1.00			1.00		
<=24 months	2,617	7.03	0.90	(0.75 - 1.09)		0.67	(0.38 - 1.18)	
24-47 months	15,592	41.86	1.66	(1.45 - 1.90)	***	1.61	(0.94 - 2.76)	
>=48 months	11,120	29.86	1.70	(1.47 - 1.96)	***	1.43	(0.82 - 2.48)	
Family planning needs satisfied								
Yes	9,135	24.53	1.00			1.00		
No	28,112	75.47	1.05	(0.91 - 1.21)		1.03	(0.89 - 1.20)	
Received skilled antenatal care								
Yes	30,238	81.19	1.00			1.00		
No	7,006	18.81	0.93	(0.81 - 1.06)	*	0.89	(0.58 - 1.37)	
Skilled attendant at birth								
Yes	27,403	73.58	1.00			1.00		
No	9,841	26.42	0.74	(0.63 - 0.87)	***	0.77	(0.58 - 1.37)	**
Full immunization								
Yes	22,175	59.54	1.00			1.00		
No	15,069	40.46	0.83	(0.68 - 1.00)	*	0.84	(0.67 - 1.05)	

*** p<0.001, ** p<0.01, * p<0.05, OR: Odds Ratios, CI: confidence interval, N = number of observations

Source: Authors' own calculations from baseline (2013) and end line (2017) survey data for the impact evaluation of Performance-Based Financing (PBF) in Burkina Faso

4 Discussion

This study aimed to investigate the main preventive health-care factors associated with under-five children's survival in Burkina Faso. The results of this study support the conceptual framework that guided this study, namely, that the intermediate variables related to preventive health-care factors and the independent variables related to the household, mother and child were associated with under-five children's survival in Burkina Faso. Improvement in preventive health care coverage (use of family planning, skilled antenatal care, SBA, and full immunization) was associated with an increase in under-five children's survival in Burkina Faso. This association was significant for the two types of populations considered in this study.

On average, the increases in CCI correlated with increases in the percentage of under-five surviving children, however not all HDs fit this trend. These findings suggest that other factors not considered here may also be influencing changes in the percentage of under-five surviving children. Further, the CCI is a composite measure, and a decline in CCI may reflect one of the components decreasing over time while other components may have increased. We were not able to assess the association of each component of the CCI with the percentage of under-five surviv-

ing children, but it is likely that some components are more strongly associated than others. For example, the results of the analysis presented in Table 4 suggest that a skilled attendant at birth is particularly important in increasing the percentage of under-five surviving children. It is therefore possible that increases in coverage of certain interventions (but not others) may result in an improvement in the percentage of under-five surviving children without a corresponding improvement in CCI.

This paper shows that several preventive health care factors are associated with children's survival. A study conducted in 35 sub-Saharan countries in 2014 (*Corsi/Subramanian* 2014) on DHS data showed that under-five children's mortality was related to the coverage of skilled antenatal care, SBA, vaccinations, and so on. Also, *Ghimire et al.* (2019) conducted a study in Nepal in 2019 that showed that family planning intervention as well as the promotion of universal skilled antenatal care (at least two doses of the tetanus vaccine) are essential in helping improve child survival in Nepal.

Another study conducted by *Walker et al.* (2013) in 71 Countdown to 2015 priority countries[2] on the patterns of maternal, newborn, and child health coverage showed that substantial reductions in child deaths are possible but only if intensified intervention efforts, e.g. for SBA, are implemented successfully within each of the Countdown countries.

It appears that health system improvements, including the scaling up of key maternal, newborn and child health (MNCH) interventions, are a key explanation for reductions in U5MR in sub-Saharan Africa. For example, in Tanzania between 1999 and 2004-05, the coverage of interventions relevant to child survival improved substantially (*Masanja et al.* 2008).

It has been suggested that effective implementation of cost-effective preventive health-care interventions can prevent much of the current under-five mortality in low-income settings (*Black et al.* 2003; *Bryce et al.* 2006; *Victora et al.* 2005). Based on our child-level analyses, it appears that the coverage of health interventions has played a relatively important role in reducing child mortality. However, it is not clear whether these improvements are being driven by supply side increases in the national or regional availability and coverage of health services and interventions, or through increased demand and access at an individual level.

Based on the results of this study, concentrated efforts aimed at sensitizing the population (especially women of childbearing age) to the use of family planning, skilled antenatal care, SBA, and child vaccination will help improve the survival of children (*Corsi/Subramanian* 2014; *Ghimire et al.* 2019; *Rockli et al.* 2018; *Walker et al*. 2013). This indicates that activities aimed at increasing knowledge and awareness of the importance of family planning, skilled antenatal care, SBA, child immunization, and other preventive measures for child survival should be conducted with women of childbearing age.

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2 The Countdown to 2015 for Maternal, Newborn, and Child Survival initiative monitors coverage of priority interventions to achieve the Millennium Development Goals (MDG) for reduction of maternal and child mortality.

In this study, it was not possible to explore certain important variables revealed in studies of factors associated with child survival, such as those related to the quality of the pregnant woman's diet, to children's nutrition in general, and to breastfeeding in particular. These variables were not taken into account in the analysis because of the quality of the information about these variables in the database. Recommendations for future research include qualitative studies to provide a much deeper understanding of the factors that contribute to child survival. Future research on this topic should explore the quality of pregnant women's nutrition, child nutrition, the beliefs of women and their partners, and the influence of partners and the extended family on issues surrounding the adoption of preventive health care with the aim of improving child survival.

5 Conclusion

This study found that children whose mothers had not received SBA at the birth of the child, those with high parity, and children who had lived in poorer and the poorest households were at greater risk of experiencing under-five mortality in Burkina Faso. Hence, to achieve Sustainable Development Goal (SDG) child survival targets, the present findings indicate the need for family planning interventions such as the promotion of contraception as well as universal SBA coverage. In addition, these interventions should target women from socioeconomically marginalized groups as well as those who have lived in poorer and the poorest households.

Burkina Faso could attain child survival Sustainable Development Goal targets if this trend of improved child survival were to be sustained. Investing in health systems and scaling up key maternal, newborn and child health (MNCH) interventions can produce a rapid improvement in child survival.

Notes

Authors' contributions: HB, ARB and HH developed the detailed plans for the fieldwork, designed the data collection instruments, implemented and supervised the fieldwork. HB and AS conceived and designed the paper and developed the analysis strategy. HB analyzed the data and wrote the first draft. All authors reviewed, made inputs to and approved the final paper. AS is the overall guarantor and the corresponding author.

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